SSP 54001

SPACE STATION PROGRAM SUPPORT REQUIREMENTS SYSTEM NETWORK PROGRAM REQUIREMENTS DOCUMENT (NPRD)

International Space Station Program

Revision K

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National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
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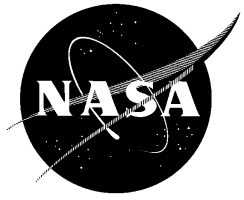

REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
H	Revision H (Reference per SSCD 006224, EFF. 11/28/01) **NOTE:** Revision H is the first release of this document on the ISS Program.	04-09-02
I	Revision I (Reference per SSCD 007577, EFF. 02-10-03)	03-24-03
J	Revision J (Reference per SSCD 009258, EFF. 02-17-04)	03-24-05
K	Revision K (Reference per SSCD 011420, EFF. 11/18/08)	12-08-08

PREFACE

The Support Requirements System (SRS) Network Program Requirements Document (NPRD) has been prepared by the National Aeronautics and Space Administration (NASA) Network and Communications Analysis and Integration Team (NACAIT) in accordance with the Space Shuttle Program and International Space Station Program "Support Requirements System Management Plan" (JSC-27379). The NPRD approximates the Universal Documentation System (UDS) structure and guidelines for the presentation of operational support requirements and approved requirements will be integrated into the Program Requirements Document (PRD) for further processing in the Automated Support Requirements System (ASRS) database maintained by the Kennedy Space Center (KSC).

This document is intended to further define and integrate the operational requirements of the Program Introduction Document (PID) SSP 54000. The NPRD contains the Space Station Program user identified Network and Communications support requirements. Support requirements initially projected in the PID are developed further in the NPRD.

This version of the NPRD contains all user identified, operational communication requirements for the International Space Station (ISS) Program utilizing NASA communication resources. New requirements will be incorporated into future releases of this document as required.

The NPRD serves as a baseline requirements document detailing all operational communications requirements (data, voice, and video) for the program beginning with First Element Launch (FEL) of the ISS Program, including preparations for FEL, and extending through the life of the program.

Operational requirements for support of ISS operations are addressed. This document is not intended to provide the ISS Program administrative communications requirements.

The NPRD is under control of Ground Segment Control Board.

Coordination and review of Network requirements is provided through the NACAIT. This document will be integrated in the NACAIT meetings, and will be submitted to the Space Station Program for approval. The NACAIT is co-chaired by Joseph M. Aquino/JSC and Philip A. Cauthen/MSFC. Comments are to be submitted to:

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Change Record

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Baseline	4/29/96	Lem Grigsby/281-483-6069	Initial Issue
A	10/17/97	Lem Grigsby/281-483-6069	Revision A - ISS Flight 6A requirements
B	9/17/98	Lem Grigsby/281-483-6069	Revision B - ISS Flight UF-1 requirements
C	2/05/99	Lem Grigsby/281-483-6069	Revision C - VV, RPI, TSC requirements
D	3/18/99	Lem Grigsby/281-483-6069	Revision D - GSFC/NCC/FDF changes; HOSC/TSC/RPI changes
E	8/31/99	Lem Grigsby/281-483-6069	Revision E - HOSC/TSC/RPI changes
F	6/01/00	Rob Frazier / 281-483-4444	Revision F – Rev E Assy Sequence
G	1/22/01	RFrazier&MTFanders/ 281-483-4444 & 6069	Revision G – HOSC/RPI/ECOMM changes
H	11/05/01	MTFanders/281-483-6069	Revision H – KSC ESR/EECOMM/TCMS Video/GIANT/ICM/NRL/VHF changes
I	11/01/02	MTFanders/281-483-6069	Revision I – Deleted domestic ESR support; Defined DSMC support; Defined NIC support; Removed specific RPI support, Changes and Addition of SSCC/CSA interface

J	1/06/05	MTFanders/281-483-6069	Revision J - Deleted CSA Support (except Video and Admin services), Changed GSFC's reference document (SSP41160 to SSP5049; SSP50272 to SSP50273), Replace NASDA with new name (excluding their specific gateway): JAXA, added Vehicle Command Echo, add contingency TDRSS scheduling at GSFC's NIC, documented SSCC to Dahlgren, VA voice circuit, Changed 2240.02.02 to the new IDEA network, added MSFC/KSC interface, added JSC ISIL to HOSC interface, added MSFC/SLSL interface, deleted Payload Ground Ancillary data definition, added MSFC to PCTS interface, Removal of Appendix A that is no longer applicable, Removed ESA Phase I NISN requirements.
K		MTFanders/281-483-6069	Revision K – Defined ISSOnet (FEPR Project), Defined BCC-HOSC service, COTS

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CATEGORY 1: PROGRAM INFORMATION-ADMINISTRATIVE AND TECHNICAL

INTRODUCTION - GENERAL INFORMATION

1100 PROGRAM DESCRIPTION

For the Program Description, reference the Station Program Implementation Plan, Volume 1: Station Program Management Plan document number SSP 50200-01 and the Program Execution Plan, Boeing document number D684-10044-1, section 1.0. Supplemental information is available via the Space Station Program Office server on the World Wide Web at address http://spaceflight1.nasa.gov/station/.

1110 MISSION AND OBJECTIVES

For Missions and Objectives, reference the Concept of Operations and Utilization, Volume I (SSP-50011-01) Section 2.1, "Mission and Objectives".

1120 ASSEMBLY PHASE BUILDUP

For a description of the Assembly Phase Buildup, reference the Concept of Operations and Utilization, Volume I (SSP-50011-01) Section 2.3, "Phase Buildup". Assembly sequence information is available via the Space Station Program Office server on the World Wide Web, at address http://spaceflight1.nasa.gov/station/.

1130 PROGRAM OPERATIONS SCHEDULE

For the currently baselined program schedule, reference the Integrated Program Schedule, Boeing document number D684-10074-01. Additionally, launch manifest information is available on the Space Station Program Office server on the World Wide Web, at address http://spaceflight1.nasa.gov/station/.

VEHICLE AND SPACECRAFT INFORMATION

1300 SPACE VEHICLE DESCRIPTION - GENERAL

For the most current Space Vehicle Description, reference the International Space Station Program Baseline Configuration Document (SSP 50037, latest revision).

The Visiting Vehicles (VVs) currently included in this NPRD are the Automated Transfer Vehicle (ATV) supplied by the European Space Agency (ESA), the H-II Transfer Vehicle (HTV) supplied by the Japan Aerospace Exploration Agency (JAXA) and vehicles vying for the Commercial Orbital Transportation Services (COTS) contract (Note: because of proprietary information, these Visiting Vehicles will have separate NPRD Annexes covering their requirements on the Integrated Network). The ATV description can be found in SSP 50335, ESA/NASA/RSA Trilateral ATV Demonstration and Nominal Operations Flight Plan and SSP 41160, Segment Specification for the European Space Agency Segment. The HTV description can be found in SSP 50273, Segment Specification for the H-II Transfer Vehicle (HTV).

CATEGORY 2 AND 3: MISSION OPERATIONAL REQUIREMENTS

OPERATIONAL CONCEPTS AND SUMMARIES

2000 OPERATIONAL CONCEPTS - GENERAL

UTILIZATION AND OPERATIONS PLANNING

The ISS on-orbit activities are supported by an operations and utilization framework which is designed to ensure manageable and safe operations that promote the basic goal of productive and flexible utilization by the ISS user community. The crew, ground controllers, ground maintenance personnel, and ground processing personnel perform the functions needed to operate and sustain the orbiting facility. A community of scientists, engineers, and commercial entities participate in and benefit from the Program by using its unique capabilities to promote scientific discovery and to develop new technologies.

The ISS is operated by the crew, onboard automation, and ground controllers. The ISS has a 24-hour autonomous capability to protect critical systems, vehicle integrity, and crew survival. The crew will have sufficient data and command capability to control subsystem operations and payload operations in order to continue human-tended utilization and vehicle operations during loss of communication with the ground facilities, or to respond to vehicle failures and contingencies. Crew tasks include support for payload operations, visiting vehicle operations, extravehicular activity (EVA), robotics, and onboard maintenance.

A team of personnel located on the ground assists the ISS in its real-time operation by planning, monitoring, and controlling ISS activities. In parallel with real-time activities, ground teams process reusable logistics modules, prepare visiting vehicle with necessary logistics, integrate the next set of payloads, and plan and conduct training for the next several increments.

OPERATIONS

The ISS on-orbit operations consists of the spacecraft system related activities, the user experiment related activities, and visiting vehicle operations and use. Likewise, the Program ground operations will have two aspects: the spacecraft systems support related activities and the user experiment support related activities.

Spacecraft systems support and mission planning and integration related activities will be performed by the ISS ground operations support at NASA field centers and the International Partners (IP) facilities. Efficient communication among ground facilities is vital to mission success. The Program will require operational and administrative links as appropriate for facilities and functions including those outlined below:

- Space Station Control Center (SSCC): The SSCC is the ISS portion of the Mission Control Center-Houston (MCC-H) located at the Johnson Space Center (JSC). It will be host to the Mission Management Team (MMT) and the overall ISS Flight Director, and it will provide functionality for overall planning and command and control of vehicle operations and flight safety, integrated across all IP elements. The SSCC will also function as the facility for the U. S. Flight control team to perform more detailed command and control of the U. S. elements, including planning, maintenance, etc. The SSCC will require communications services to support these operations responsibilities. Real-time systems operations data will flow between the SSCC and the ISS. Vehicle systems data, planning data, voice, and video will flow between JSC and various U. S. and IP ground facilities.

- Mission Control Center-Moscow (MCC-M): The MCC-M, at Korolev, Russia, under the oversight of the MMT and in coordination with the SSCC, is responsible for the launch, rendezvous, docking, and on-orbit operation of Russian elements and vehicles. The MCC-M is responsible for control of selected core systems functions elsewhere in the ISS. These functions will primarily use the Russian communications and tracking (C&T) resources, but may also be performed via the interface to the SSCC and its space-to-ground communications systems. Interfaces are required between the SSCC and the MCC-M for data and voice.

- Huntsville Operations Support Center (HOSC) - The HOSC, located at the Marshall Space Flight Center (MSFC), provides the operational environment for all MSFC-supported space programs. It incorporates all systems required to perform data acquisition and distribution, telemetry processing, command services, database services, mission support services, and system monitoring and control. The Payload Operations Integration Center (POIC), located in the HOSC, will require communications services to support all utilization flights and all other increments supporting payload installation and operations during assembly phase. The POIC will exchange real-time and near real-time data with geographically distributed user facilities in the U. S. and at IP locations. Payload commands and other data will be routed from the user facilities to the POIC for integration into the forward link command stream at the SSCC. The Payload Data Services System (PDSS), located in the HOSC, will be responsible for payload data processing and distribution. The PDSS will require communications services to receive ISS telemetry data and distribute payload data to user facilities in the U. S. and at IP locations. Communications requirements contained in this document for the POIC, PDSS, Remote Area for Payload Support (RAPS), and other MSFC operational facilities are routed through the HOSC.

- Backup Control Center-HOSC (BCC-HOSC): The BCC-HOSC, located in Huntsville, Alabama, is a backup control center facility to the Mission Control Center (MCC), located in Houston, Texas. The BCC-HOSC is a warm backup facility, capable of providing basic MCC services to the ISS at a full 24 hour period 365 days a year. The full BCC-HOSC capabilities may be activated in the event that MCC is unavailable due to natural or human-caused disasters. The BCC-HOSC will provide flight control services for up to 10 JSC flight controllers. The BCC-HOSC is optimized to provide basic flight control services for up to 30 days. In the event that the BCC-HOSC is activated, initial use of the facility will be by way of FIPS 140-2 Level 2 secured Mobile Computing System (MCS) laptops, from locations physically remote from the BCC-HOSC, such as Austin, Texas. In the event that an MCC outage is expected to be severe or otherwise span several days or weeks, select JSC flight control personnel will physically travel to and staff the BCC-HOSC in Huntsville.

- Telescience Support Center (TSC): The TSC is a NASA funded facility which provides the capability to plan and operate on-orbit facility class payloads and experiments, other payloads and experiments, and instruments.

- International Partners (IP) Facilities: The IP facilities are responsible for the coordinated command and control of IP systems and payloads. Data relating to IP ISS systems and experiments will be transferred to and from the Italian Space Agency (ASI), CSA, ESA, and JAXA. The IP's will provide communications services from a designated termination point to their facilities. Note: Due to contractual agreements, the Japanese's Gateway is still officially known as the National Space Development Agency of Japan (NASDA) Gateway.

- Training Facilities: Training facilities, including the Space Station Training Facility (SSTF) and the Payload Training Capability (PTC) at JSC, will provide ISS core systems and payload systems training for Program crews, ground support personnel, and users. This will require communications services to transfer Instructor Station data and simulated Space Station data, voice, and video.

- Automated Transfer Vehicle (ATV) Control Center (ATVCC): The ATV-CC, hosted by the Centre National d'Études Spatiales (CNES) in Toulouse (France), on behalf of the European Space Agency (ESA), contains the monitoring and control systems for operating the ATV from launch to docking, during attached phases and from de-docking to destructive re-entry. For communications, the ATV spacecraft relies on both the TDRS System and ARTEMIS (Advanced Relay and Technology Mission Satellite). The ATV operations are agreed upon and described in the "ATV Flight Planning Ground Rules & Constraints". The interfaces between the ATV-CC and SSCC are agreed upon and described in the SSCC to ESA GS ICD Part I and II (SSP 45011).

- H-II Transfer Vehicle (HTV) Control Center (HTVCC): The JAXA H-II Transfer Vehicle (HTV) Control Center (HTVCC) will be located in the Space Station Integration and Promotion Center (SSIPC) in Tsukuba Space Center, Japan. The HTVCC will monitor and control the HTV from launch to ISS berthing, during attached phases and from unberthing to destructive- re-entry. During all phases of operation, the HTVCC will control the HTV spacecraft while under the authority of SSCC during critical approach, berthing, attached, and unberthing phases. The main functions of the HTVCC are flight planning, flight control, training and test, and interfaces to the external operational organizations. HTVCC flight planning will include trajectory planning, and flight evaluation for mission analysis. Re-planning will also occur in the HTVCC for contingencies during real-time operations. HTVCC flight control includes telemetry processing and command generation. The flight control function will supply functions to assist "GO/NO GO" judgment of the operator such as calculation of error ellipsoid to judge possibility of collision between HTV and ISS, evaluation of flight status based on HTV telemetry, and evaluation of flight status after maneuvers. The HTVCC will house the functionality to perform HTV Training and Test. The Training and Test support will develop HTVCC training scenarios and closed loop training using simulation software. Simulation capability will include GNC on-board software modeling, Sensor/Actuator mathematical modeling, environmental modeling (HTV dynamics, ISS dynamics, disturbance, etc,) and, communication systems model (On-board and Ground systems) for both the TDRS link and ISS link. The HTVCC interfaces with SSCC via JEM Network System for HTV flight planning, command and telemetry, video, voice loops between HTVCC, SSCC and onboard crews related to HTV operations. The HTVCC will also house interface equipment for CCSDS processing of HTV command and telemetry for the TDRS Link. The HTVCC also interfaces with the launch site for HTV launch operation.

- White Sands Complex (WSC): The WSC located in Las Cruces, New Mexico is the facility that houses the ground segment elements of the Tracking and Data Relay Satellite System (TDRSS). One element of the ground segment is the TDRSS Operations Control Center (TOCC). The TOCC controls and monitors the TDRSS spacecraft fleet and monitors TDRSS performance during active Customer services.

- Data Services Management Center (DSMC): The DSMC located at the WSC provides scheduling, controlling and monitoring of the SN. This function includes control of all available network resources, schedule processing, conflict resolution, and performance monitoring/fault isolation and acquisition data dissemination. These functions allow the SN users to receive User Performance Data (UPD), transmit Ground Control Messages Request (GCMR) and schedule SN services.

- Network Integration Center (NIC): The NIC is located at the Goddard Flight Center (GSFC), Maryland. The NIC will monitor ISS activities as required such as Soyuz launch/docking, ISS mission critical periods, and ISS VHF ground station support. The NIC will provide the BCTC (Backup Communications Team Center) for operational scheduling of TDRSS to maintain S-Band (and limited Ku-Band) support during times when MCC-H is evacuated due to emergency situations. JSC controllers will staff two NIC provided consoles.

- Flight Dynamics Facility (FDF): Located at the GSFC in Greenbelt, Maryland, the FDF will provide state vector data and tracking data evaluation support for the ISS, ATV, and HTV missions. The FDF also has the ability to provide orbit determination support if required. Real-time support is also provided for Space Shuttle missions and Expendable Launch Vehicles (ELV). Additional support is provided for TDRSS performance assessment for the STDN/TDRSS System using tracking data from the ISS, Space Shuttle, scientific satellites, and special tests. TDRSS support includes state vector generation, orbit determination, tracking data evaluation, spacecraft maneuver support and testing to verify and improve TDRS pointing accuracy. The FDF also provides spacecraft planning products to the DSMC and other spacecraft and launch vehicle control centers.

2000.01 SECURITY REQUIREMENTS

NISN-provided communications services shall comply with NASA Procedures and Requirements (NPR) 2810.1, "Security of Information Technology" (latest revision), and FIPS Publication 200, "Minimum Security Requirements for Federal Information and Information Systems". The latter document directs Federal agencies to implement baseline controls from NIST 800-53, "Recommended Security Controls for Federal Information Systems", as applicable to the sensitivity of the data the equipment or system processes. The following are data sensitivity classifications used throughout this document in reference to services listed below:

"Space Operations Information" refers to those mission services having the security category = {(confidentiality, Low), (integrity, High), (availability, High)}, according to the security classification method required by FIPS Publication 199, "Standards for Security Categorization of Federal Information and Information Systems". See NIST 800-60, "Guide for Mapping Types of Information and Information Systems to Security Categories", volume 2, section D.11.4, "Space Operations Information Type". These services were formerly known as MSN and AIS Level 3.

"Space Exploration Information" refers to those mission services having the security category = {(confidentiality, Low), (integrity, Moderate), (availability, Low)}, except as modified below by explicit requirements for a particular service. See NIST 800-60, "Guide for Mapping Types of Information and Information Systems to Security Categories", volume 2, section D.19.2, "Space Exploration and Innovation Information Type". These services were formerly known as SER and AIS Level 2.

In addition, the users of NISN services shall comply with the NMI 8610.11 (latest revision, which has expired), "Control of Access to Operational Voice Communications Circuits" (and its eventual replacement policy currently being drafted by JSC/MOD/DA8) to preclude unauthorized access and potential damage to operational systems and user security. Inter-facility Interface Control Documents (ICD's) shall address security.

2010 SPACE AND GROUND SUPPORT INSTRUMENTATION SUMMARY

2010.01 TRACKING AND DATA RELAY SATELLITE SYSTEM

The Tracking and Data Relay Satellite System (TDRSS) shall support the International Space Station (ISS) Program by providing S-Band and Ku-Band communications. TDRSS S-Band Single Access (SSA), S-Band Multiple Access (MA), and Ku-Band Single Access (KSA) capabilities shall support the various ISS Program Communications and Tracking (C&T) Systems.

Service for different ISS S-Band systems is required. These systems currently consist of the Assembly Contingency Subsystem (ACS) S-Band system, ATV S-Band system, HTV S-Band system, and commercial entities vying for the COTS contract. One SA service is required to support S and K band RF links with a second SA service required during critical ISS operations such as rendezvous, EVA, VV launch, and other critical activities.

The ISS ACS SSAF link data rate operates at 72 kbps (High Data Rate mode) or 18 kbps (Low Data Rate). ACS SSAR link data rate operates at 192 kilobits per second (kbps) (High Data Rate mode) and 24 kbps (Low Data Rate).

TDRSS support is required for one ISS Ku-band service (forward and return) starting with the Space to Ground System (SGS) activation on flight 5A.1. The ISS SGS Ku-band return link signal is 150 Mbps containing payload data, video, and on-board recorded telemetry. The Ku-band return link data rate may be upgraded to 300 Mbps in the future.

The ISS requires a Ku-band Single Access Forward (KSAF) link service. The KSAF will be either a PN spread signal or a 3 Mbps data modulated signal. The PN spread signal will be used for ISS antenna autotrack operations only and may be any PN code. The Ku-band forward link data rate may be upgraded to approximately 7-25 Mbps in the future.

The ATV S-Band system operates in MA at 8 kbps return link and 1 kbps forward link. The ATV S-Band system operates in SSA at 8 or 64 kbps return link and 1 kbps forward link. The ATV shall require continuous TDRSS forward and return link, including the Zone of Exclusion (ZOE), during critical phases of flight. In addition, ATV will utilize TDRSS covering the attached phase periodically and will share TDRSS time with ISS.

The HTV S-Band forward link system operates at 250 bps SSA only. No MA forward link is required. The HTV S-Band return link system operates in SSA at 8 kbps normal, or 2.0 kbps contingency. The HTV MA return link operates at 2.0 kbps normal. The HTV shall require continuous TDRSS forward and return link, including the Zone of Exclusion (ZOE), during critical phases of flight.

COTS requirements will be documented in separate NPRD annexes.

Detailed technical interface requirements and link performance requirements are specified in the ISS to Ground through TDRSS Interface Control Document (ICD) SSP 42018. (Non-continuous TDRSS support will be required for pre-flight testing of each service on a scheduled basis.)

The ISS Program requires one dedicated SA service providing S-Band and Ku-band single access service for prime ISS support, with continuous TDRSS coverage except for periods of interruption necessitated by ISS masking, the zone of exclusion (ZOE), or TDRS handover, with limited two SA support during critical events. Critical periods will be defined through negotiations between the GSFC Network Director and the ISS Program. Coverage during ZOE transit via the Guam Remote Ground Terminal (GRGT) is required for all ISS S-Band elements, but KSA services are not required during ZOE.

2010.02 SYSTEM VERIFICATION

GSFC will support a validation/verification process that demonstrates compatibility, technical performance, capabilities, and operational readiness between ISS elements and the TDRSS, GN and VHF communication systems.

The NASA Integrated Services Network (NISN) will support a validation/verification process that demonstrates technical performance, capabilities, and operational readiness of all NISN provided Ground to Ground communications services.

Note: The following requirements documented throughout the remainder of the NPRD contain references to terms that are defined in the glossary in Appendix A to the NPRD. Committed Information Rate (CIR) is one such term, Voice over Internet Protocol (VoIP) is another. The NISN has defined four service performance categories for IP routed data services. For ease of reference, the definitions and table describing performance specifications for IP routed data contained in the NISN Services Document (Latest version) are reprinted in Appendix A. By documenting, in the NPRD, one of the four service performance categories as defined by the NISN as a requirement for a particular data service, the ISS Program requires that data service to meet the performance specifications (Availability, Maximum Time to Restore, and Acceptable Packet Loss) described in the aforementioned table. Latency requirements established by the ISS Program will be documented in the NPRD. Further, the NISN Services Document denotes three NISN services for voice communications. These are conference, switched, and dedicated. All ISS voice requirements documented in the NPRD are dedicated services unless otherwise noted. The ISS Program has identified three availability categories for the dedicated mission voice services documented in the NPRD. These are Critical, Noncritical Highly Desirable (NCHD), and Noncritical Routine (NCR). It is strongly recommended that the reader reference the glossary in Appendix A for the definition of these highly relevant terms.

2010.02.01 ISS ELEMENT INTEGRATION TEST (EIT) AT KSC - SSPF

Note: Future EIT testing requirements are still being defined. The following requirements serve as a placeholder.

a. The following data services will be transported via the ISS Operational Network (ISSOnet) (reference 2700.01).
b. A 192 / 24 service from KSC - SSPF to
JSC - SSCC shall be provided for the transfer of test S-Band return data. The high and low data rates will not be required simultaneously.
c. A 72 / 18 service from JSC - SSCC to KSC - SSPF shall be provided for the transfer of test S-Band forward link data. The high and low data rates will not be required simultaneously.
d. A 192 / 24 service from WSC to SSCC shall be provided for the transfer of test S-Band downlink telemetry. The high and low data rates will not be required simultaneously.
e. A 72 / 18 service from SSCC to WSC shall be provided for the transfer of test S-Band uplink data. The high and low data rates will not be required simultaneously.
f. A 192 / 24 service from WSC to HOSC shall be provided for the transfer of test S-Band downlink telemetry. The high and low data rates will not be required simultaneously.
g. In support of EIT testing, a relay from KSC to TDRS may be required.
h. The following voice services shall be provided for support of EIT testing.

Note: Future EIT testing may require K-Band uplink.

Function	Description	Number of Circuits (ckts)	Availability
2010.03.02.1	GSFC to KSC Test Coordination	1	Routine
2010.03.02.1	GSFC to WSC Test Coordination	1	Routine
2010.03.02.1	GSFC to JSC Test Coordination	2	Routine
2010.03.02.1	GSFC to MSFC Test Coordination	1	Routine

Table 2010.02.01.1 Voice Service

2010.03 NETWORK MANAGEMENT

The Program requires the Mission Services Program to provide network management services for all communications networks. These services shall include, but not be limited to: scheduling, monitoring performance, providing status to the Program, and providing network configuration management.

- The networks provided shall be managed and operated in such a way as to minimize the need for operational interaction between network operators and SSCC/POIC operators and/or payload users.

2010.04 QUALITY OF SERVICE

The data systems at the White Sands Complex (WSC) shall monitor the systems supporting the forward and return data services for all ISS elements requiring TDRSS support. User Performance Data (UPD) shall be transmitted to the SSCC, GSFC NIC and the HOSC.

2100 C-BAND RADAR SUPPORT

NASA and DoD C-Band radar support is required for ISS free-flyer support. Support is currently estimated at approximately 15 passes per year and will be scheduled as required. Currently, use of C-Band Metric Data is to support the:

1. Tracking of the Soyuz to provide updated pointing information for the VHF-2 communications systems at the NASA VHF stations.
2. Other ISS free flying elements including Progress, HTV, and ATV as required.

2112 TDRS STATE VECTORS

When required, the GSFC FDF shall provide the SSCC and BCC-HOSC (when activated) with Tracking and Data Relay Satellite (TDRS) state vectors for ISS-to-TDRS pointing computations and for Visiting Vehicles-to-TDRS pointing computations to the SSCC. TDRS state vectors for ATV and HTV support will be supplied by the SSCC to the ESA and NASDA gateways as required**.** The TDRS state vector accuracy requirement is 200 meters, three sigma. State vector formats are specified in JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. 1, latest revision). Vectors will be transmitted between FDF and SSCC via ISSOnet (reference 2700.01)

2113 ISS STATE VECTORS

The JSC SSCC and BCC-HOSC (when activated) shall provide, as required, ISS, ATV, HTV, and Soyuz acquisition data to the TDRS via GSFC FDF. The ATV and HTV acquisition data shall be provided by the ATV and HTV control centers, respectively, to the SSCC. State vector formats are specified in JSC/GSFC Operational Communications ICD for Mission Systems (JSC 11534, Vol. 1, latest revision). Vectors will be transmitted between FDF and SSCC via ISSOnet (reference 2700.01)

2113.1 VISITING VEHICLE PRE-LAUNCH, LAUNCH, and EARLY ORBIT PHASES

Trajectory information exchange will follow this timeline:

L -18 Months to L - 1 Month:

After completion of each ATV Flight Design cycle, ESA will provide MCC-H with the resulting ATV trajectory analysis. MCC-H will forward the trajectory analysis results to GSFC FDF.

L – 1 Month to L – 1 Day:

As required, ESA will provide MCC-H with detailed ATV trajectory data, including insertion vectors and predicted post-maneuver vectors. MCC-H will forward this vector data to GSFC FDF.

ESA and JAXA will provide the GSFC FDF (via MCC-H) with electronic data defining the launch vehicle trajectory from launch through spacecraft separation. Since this is a rendezvous, requiring inertial place targeting, multiple trajectories may be required to define the trajectory across the launch window.
ESA and JAXA will provide the GSFC FDF (via MCC-H) with electronic data defining the Visiting Vehicle trajectory from spacecraft separation to rendezvous with the ISS. Data is required by launch minus 90 days.

Both ascent and post spacecraft separation phases of the mission may be merged into one electronic trajectory file in a ***TBD*** format.

Trajectory data is required for pre-mission trajectory analysis and as a source for launch support state vectors. These launch support vectors are required for TDRSS pointing during the launch phase.

2113.2 EARTH ORBIT PHASES

ESA and JAXA will provide the GSFC FDF (via MCC-H) with updated electronic trajectory data for ATV and HTV in real-time to maintain TDRS pointing. Vectors should be formatted in accordance with the JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. I, latest revision). GSFC FDF will provide (via MCC-H) ESA and JAXA with an orbit solution within 100 meters, 1 sigma.

2113.3 REENTRY PHASE

ESA, JAXA and SSCC will provide the GSFC FDF with electronic data defining the Visiting Vehicle trajectory from undocking through reentry. Predicted reentry vector will be supplied by ESA and JAXA (via MCC-H) eight (8) days prior to undocking. The Visiting Vehicle Control Center/SSCC will notify the GSFC FDF 48 hours prior to Visiting Vehicle undocking. Trajectory data is required no later than (NLT) 4 hours prior to the event. Vectors should be formatted in accordance with the JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol I, latest revision).

2116 ISS TRANSMITTED FREQUENCY MEASUREMENT

The GSFC FDF shall process ACS S-Band, ATV S-Band, HTV S-Band, and Ku-Band one-way doppler data to be used for determining the operational short and long term stability of the ISS transponders. This processing shall be provided, when scheduled, until transponder frequency shift signatures are established for all S-Band services and the Ku-Band service. Results shall be provided to the SSCC for use in estimating the required frequency information in the TDRSS scheduling and ground control messages.

The responsible Visiting Vehicle control center shall process appropriate data to be used for determining the operational short and long term stability of the transponders. This processing shall be provided when scheduled until transponder frequency shift signatures are established for S-Band services. Results shall be provided to the SSCC, ATVCC, and HTVCC for use in estimating the required frequency information in the TDRSS scheduling and ground control messages.

2200 TELEMETRY MEASUREMENT AND DATA

2210 RECORDING INTERVAL

The ATV and HTV S-Band return links shall be recorded at the White Sands Complex (WSC) for all ISS elements and held for a period of 50 hours or longer if specifically requested. Playback shall be required in the event of communications or facility failures. Playback of S-Band data shall occur simultaneously (on a separate channel) with realtime support. Playback of ATV and HTV S-Band data shall utilize one common, shared playback channel.
Note: ACS and Ku-Band return links are recorded by ISSOnet (reference 2700.01) equipment located at WSC.

2240 DECOMMUTATION PROCESSING SPECIFICATIONS

The ISS ACS S-Band Single Access Return (SSAR) and Ku-Band Single Access Return (KSAR) data shall be transported from the WSC to the SSCC and the MSFC HOSC. The S-Band Multiple Access (MA) Return, ATV SSAR and S-Band MA Return, and the HTV SSAR and S-Band MA Return shall be transported from the WSC to the SSCC.

The ACS SSAR link data rate operates at 192 kbps (High Data Rate mode) and 24 kbps (Low Data Rate). The ISS ACS System can be operated coherently or non-coherently, but generally in the non-coherent mode.

The ATV SSAR link data rate operates at 64 or 8 kbps. The ATV S-Band MA Return link data rate operates at 8 kbps. The ATV S-Band system can be operated coherently or non-coherently. ATV requirement for TDRSS coherent mode operation is for ATV tracking purposes only.

The HTV SSAR link data rate operates at 8 or 2 kbps. The HTV S-Band MA Return link data rate operates at 2 kbps. The HTV S-Band system can be operated coherently or non-coherently. HTV requirement for TDRSS coherent mode operation is for HTV tracking purposes only.

The KSAR link data rate operates at 150 Megabits per second (Mbps).

2240.01 S-BAND SERVICE REQUIREMENTS

2240.01.01 S-BAND RETURN DATA FROM WSC TO THE SSCC

2240.01.01.1 ACS S-BAND RETURN FROM WSC TO SSCC

a. The following data services will be transported via the ISSOnet (reference 2700.01).
b. A 192 / 24 service shall be provided for the transfer of S-Band downlink telemetry.
c. A 192 / 24 service shall be provided for the transfer of recorded S-Band downlink telemetry. The recorded HTV S-Band service and recorded ATV S-Band service shall share a single ISS recorded S-Band service configurable to 192 / 64 / 24 / 12 / 8 / 2 / 1 kbps data rates.
d. A 72 / 18 service shall be provided for the transfer of S-Band ISS command echo.
e. The communications service shall be capable of handling rate changes between 192 kbps and 24 kbps.
f. Refer to TBS for detailed interface requirements.

2240.01.01.2 HTV S-BAND RETURN FROM WSC TO SSCC

a. An 8 / 2 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of S-Band downlink telemetry.
b. An 8 / 2 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of recorded S-Band downlink telemetry. The recorded HTV S-Band service and recorded ATV S-Band service shall share a single ISS recorded S-Band service configurable to 192 / 64 / 24 / 12 / 8 / 2 / 1 kbps data rates.
c. A 250 bps, synchronous, serial bitstream data and clock service shall be provided for the transfer of HTV command echo.
d. A NISN Realtime Critical Service is required.
e. The interface shall provide security appropriate for "Space Operations Information".
f. The data transport delay shall not exceed 600 ms from WSC to SSCC. The delay shall not vary.
g. The maximum bit error rate shall be 10E-6.
h. The communications service shall be transparent to the NASDA Gateway. (i.e., the data shall be presented by the communications equipment to the NASDA Gateway in the same format as that presented by the WSC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the NASDA Gateway and shall require no additional processing or data handling capabilities on the part of the NASDA Gateway. The data provided by the WSC shall not be altered by the communications service).
i. The communications service shall be capable of handling rate changes between 8 and 2 kbps.
j. Refer to JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. I, latest rev.) for detailed interface requirements.

2240.01.01.3 ATV S-BAND RETURN FROM WSC TO SSCC

a. An 8 / 64 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of S-Band downlink telemetry.
b. An 8 / 64 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of recorded S-Band downlink telemetry. The recorded HTV S-Band service and recorded ATV S-Band service shall share a single ISS recorded S-Band service configurable to 192 / 64 / 24 / 12 / 8 / 2 / 1 kbps data rates.
c. A 1 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of ATV command echo.
d. A NISN Realtime Critical Service is required.
e. The interface shall provide security appropriate for "Space Operations Information".
f. The data transport delay shall not exceed 600 ms from WSC to SSCC. The delay shall not vary.
g. The maximum bit error rate shall be 10E-6.
h. The communications service shall be transparent to the ESA Gateway. (i.e., the data shall be presented by the communications equipment to the ESA Gateway in the same format as that presented by the WSC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the ESA Gateway and shall require no additional processing or handling capabilities on the part of the ESA Gateway. The data provided by the WSC shall not be altered by the communications service).
i. The communications service shall be capable of handling rate changes between 8 and 64 kbps.
j. Refer to JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. I, latest rev.) for detailed interface requirements.

2240.01.02 S-BAND RETURN DATA FROM WSC TO THE HOSC

2240.01.02.1 ACS S-BAND RETURN DATA FROM WSC TO THE HOSC

a. The following data services will be transported via the ISSOnet (reference 2700.01).
b. A 192 / 24 service shall be provided for the transfer of S-Band downlink telemetry.
c. A 192 / 24 service shall be provided for the transfer of recorded S-Band downlink telemetry.
d. The communications service shall be capable of handling rate changes between 192 kbps and 24 kbps.
e. Refer to ***TBS*** for detailed interface requirements.

2240.02 KU-BAND SERVICE REQUIREMENTS

2240.02.01 KU-BAND RETURN DATA FROM WSC TO THE SSCC

NISN shall provide a fiber terrestrial communications network for the distribution of ISS Ku-band downlink data. This network shall support data rates from 50 Mbps to 150 Mbps.

a. The input to the network shall be IP packets, and the output to the SSCC is required to be in the same format as that provided to the network.
b. NISN shall provide a 56 kbps out-of-band frame relay cloud for network management and status reporting.
c. The total service availability of the network shall not be less than 0.9995 percent.
d. The maximum downtime shall not exceed 2 hours for any single outage.
e. A NISN Mission Critical Service is required.
f. The interface shall provide security appropriate for “Space Exploration Information”.
g. The maximum acceptable packet loss is .001 percent.
h. The one-way data transport delay shall not exceed 100 ms.
i. The communications service shall be transparent to the SSCC (i.e., the data shall be presented by the communications equipment to the SSCC in the same format as that presented by the WSC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the SSCC and shall require no additional processing or data handling capabilities on the part of the SSCC. The data provided by the WSC shall not be altered by the communications service).
j. Reference MSFC-PLAN-3340, IDEA Development Plan for more detailed requirements.

2240.02.02 KU-BAND RETURN DATA FROM WSC TO THE HOSC

NISN shall provide a fiber terrestrial communications network for the distribution of ISS Ku-band downlink data. This network shall support data rates from 50 Mbps to 150 Mbps.

a. The input to the network shall be IP packets, and the output to the MSFC is required to be in the same format as that provided to the network.
b. NISN shall provide a 56 kbps out-of-band frame relay cloud for network management and status reporting.
c. The total service availability of the network shall not be less than 0.9995 percent.
d. The maximum downtime shall not exceed 2 hours for any single outage.
e. A NISN Mission Critical Service is required.
f. The interface shall provide security appropriate for "Space Exploration Information".
g. The maximum acceptable packet loss is .001 percent.
h. The one-way data transport delay shall not exceed 100 ms.
i. The communications service shall be transparent to the HOSC (i.e., the data shall be presented by the communications equipment to the HOSC in the same format as that presented by the WSC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the HOSC and shall require no additional processing or data handling capabilities on the part of the HOSC. The data provided by the WSC shall not be altered by the communications service).
j. Reference MSFC-PLAN-3340, IDEA Development Plan for more detailed requirements.

2300 COMMAND CONTROL

2310 COMMAND AND CONTROL

2310.01 S-BAND SUPPORT REQUIREMENTS

The three ISS S-Band Single Access Forward (SSAF) links and one S-Band MA forward links originate at the SSCC and shall be transported to the WSC.

The ISS ACS SSAF link data rate operates at 72 kilobits per second (kbps) (High Data Rate mode), or 18 kbps (Low Data Rate).

The ATV SSAF link operates at 1 kbps. The ATV S-Band forward link data rate operates at 1 kbps in MA. The HTV SSAF link operates at 250 bps.

2310.01.01 ACS S-BAND FORWARD SUPPORT FROM SSCC TO WSC

a. The following data services will be transported via the ISSOnet (reference 2700.01).
b. A 72 / 18 service shall be provided for the transfer of spacecraft uplink data.
f. Refer to TBS for detailed interface requirements.
g. The communications service shall be capable of supporting rate changes between 72 kbps and 18 kbps.
h. The WSC shall remove the modulation from the TDRSS forward link to the ISS when signals are removed at the SSCC output.

2310.01.02 HTV S-BAND FORWARD SUPPORT FROM SSCC TO WSC

a. A 250 bps, synchronous, serial bitstream data and clock service shall be provided for the transfer of spacecraft uplink data.
b. A NISN Realtime Critical Service is required.
c. The interface shall provide security appropriate for "Space Operations Information".
d. The data transport delay shall not exceed 400 ms from SSCC to WSC. The delay shall not vary.
e. The maximum bit error rate shall be 10E-6.
f. The communications service shall be transparent to the WSC. (i.e., the data shall be presented by the communications equipment to the WSC in the same format as that presented by the SSCC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the WSC and shall require no additional processing or data handling capabilities on the part of the WSC. The data provided by the SSCC shall not be altered by the communications service).
g. Refer to JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. I, latest rev) for detailed interface requirements.
h. The WSC shall remove the modulation from the TDRSS forward link to the ISS when signals are removed at the SSCC output.

2310.01.03 ATV S-BAND FORWARD SUPPORT FROM SSCC TO WSC

a. A 1 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of spacecraft uplink data.
b. A NISN Realtime Critical Service is required.
c. The interface shall provide security appropriate for "Space Operations Information".
d. The data transport delay shall not exceed 400 ms from SSCC to WSC. The delay shall not vary.
e. The maximum bit error rate shall be 10E-6.
f. The communications service shall be transparent to the WSC. (i.e., the data shall be presented by the communications equipment to the WSC in the same format as that presented by the SSCC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the WSC and shall require no additional processing or data handling capabilities on the part of the WSC. The data provided by the SSCC shall not be altered by the communications service).
g. Refer to JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. I, latest rev) for detailed interface requirements.
h. The WSC shall remove the modulation from the TDRSS forward link to the ISS when signals are removed at the SSCC output.

2310.02 KU-BAND SUPPORT REQUIREMENTS

The ISS requires either a pseudo-random (PN) spread or data modulated Ku-Band Single Access Forward (KSAF) link. A given TDRSS support event may contain data modulation or PN spreading, but not at the same time. The service will be configured by ground control message requests (GCMR) during the event to switch between data modulated or PN spread.

Data will originate at the SSCC and be transported to WSC at 3 Mbps. In the future, an ISS upgrade to accommodate a data rate of 7 Mbps may occur. The PN spreading is used by the ISS for autotrack operations only and can be any PN code.

2310.02.01 KU-BAND FORWARD SUPPORT FROM SSCC TO WSC

NISN shall provide a fiber terrestrial communications network for the distribution of ISS Ku-band spacecraft uplink data. This network shall support data rate of 3 Mbps.

a. The input to the network shall be IP packets, and the output to the SSCC is required to be in the same format as that provided to the network.
b. NISN shall provide a 56 kbps out-of-band frame relay cloud for network management and status reporting.
c. The total service availability of the network shall not be less than 0.9995 percent.
d. The maximum downtime shall not exceed 2 hours for any single outage.
e. A NISN Mission Critical Service is required.
f. The interface shall provide security appropriate for "Space Exploration Information".
g. The maximum acceptable packet loss is .001 percent.
h. The one-way data transport delay shall not exceed 100 ms.
i. The communications service shall be transparent to the SSCC (i.e., the data shall be presented by the communications equipment to the SSCC in the same format as that presented by the WSC to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the SSCC and shall require no additional processing or data handling capabilities on the part of the SSCC. The data provided by the WSC shall not be altered by the communications service).
j. Reference MSFC-PLAN-3340, IDEA Development Plan for more detailed requirements.

2400 SPACE/GROUND VOICE COMMUNICATIONS

2400.01 S-BAND

The Program requires the bi-directional transfer of digital audio between the ISS and the Program ground systems. Digital audio is contained in the S-Band return and S-Band forward services of sections 2240.01 and 2310.01 respectively.

2400.02 VHF

Communications services shall be provided between the SSCC and the VHF ground stations located at Dryden Flight Research Center, the White Sands Complex, and Wallops Flight Facility/Tracking Station for the bi-directional transmission of voice. Additionally, a VHF site voice coordination loop interconnecting the control centers, communications facilities, and the VHF ground stations is required.

The capability is required to uplink and downlink Space-to-Ground VHF voice communications between the MCC-H, MCC-M, and the ISS via Dryden Flight Research Center (DFRC), Wallops Flight Facility (WFF), and the White Sands Complex (WSC) ground stations as scheduled.

The Service Module (SM) VHF-1 voice/packet data downlink frequency is 143.625 MHz and the uplink frequency is 139.208 MHz. The modulation is FM with a deviation of plus or minus 10 kHz. Support passes will be scheduled on request.

In addition to normal uplink/downlink support of SM VHF-1, the sites are required to provide downlink receive capability on Soyuz-TM VHF-2 at a frequency of 121.750 Mhz. Uplink capability on VHF-2 at a frequency of 130.167 Mhz is for emergency use only.

VHF 1 and VHF 2 support at DFRC, WFF, and WSC will be on a 4 hour call up and scheduled in case of Soyuz or ISS spacecraft emergency. Operator proficiency passes will be scheduled as needed (approximately 6 passes per year per site). VHF 2 support will be scheduled after each Soyuz launch, two Soyuz launches are projected per year. Approximately 6 passes per launch will be scheduled as follows: 3 at WLPS, 2 at WSC, and 1 at DFRC.

All view period support from Wallops, White Sands and Dryden on ISS VHF1 and Soyuz VHF2 is required during any Soyuz or ISS spacecraft emergency for the duration of ISS operations.

Note: WSC will support VHF-1 passes that are less then 20 degrees elevation on a best effort basis only.

2700 GROUND COMMUNICATIONS REQUIREMENTS

This section contains the requirements for operational voice and data communications required in support of the Space Station Program.

2700.01 ISS OPERATIONAL NETWORK (ISSOnet)

ISSOnet (formally known as the FEPR network) is a Layer 3 ISS managed private routed network within the NISN provided Multi Protocol Label Switching (MPLS) Layer 2 infrastructure. Serial Conversion Processors (SCPs), located at WSC and KSC, provide Level-0 processing for the routing of the data. The Layer 2 network consists of:

a. 9 Mbps between JSC/WSGT shall be provided.
b. 9 Mbps between JSC/STGT shall be provided.
c. 6 Mbps between MSFC/WSGT shall be provided.
d. 6 Mbps between MSFC/STGT shall be provided.
e. 1 Mbps between WSGT/GSFC shall be provided.
f. 1 Mbps between STGT/GSFC shall be provided.
g. 1 Mbps between KSC/JSC shall be provided.
h. A NISN Realtime Critical Service is required.
i. The interface shall provide security appropriate for "Space Operations Information".
j. The data transport delay shall not exceed 600 ms from center to center. The delay shall not vary.
k. The maximum bit error rate shall be 10E-6.

The communications service shall be transparent to the WSC. (i.e., the data shall be presented by the communications equipment to the WSC in the same format as that presented by the centers to the communications equipment. Any overhead added by the communications service shall be removed from the data prior to delivery to the WSC and shall require no additional processing or data handling capabilities on the part of the WSC. The data provided by the centers shall not be altered by the communications service).

2730 VOICE COMMUNICATIONS REQUIREMENTS

NISN shall provide voice communications services for voice communications between the SSCC, HOSC, NASA Centers, and the Houston Support Room (HSR)/MCC-M. Table 2730.1 details the number of voice circuits required.

Function	Description	Number of Circuits (ckts)	ISS Classification
2730.01	SSCC to HOSC (mission/simulation support)	144	NCHD
2730.01.01	SSCC to HOSC (JSC TSC support)	5	NCHD
2730.01.02	SSCC to HOSC (PAO support)	5	NCHD
2730.02	SSCC to GSFC (mission/simulation support)	7	NCHD
2730.03	SSCC to MCC-M (mission/simulation support)	24	Critical
2730.03.01	SSCC to MCC-M (mission/simulation support)	24	NCHD
2730.04	HOSC to GSFC (mission support)	6	NCHD
2730.05	HOSC to ARC TSC (mission/sim support)	24	NCHD
2730.06	HOSC to GRC TSC (mission/sim support)	48	NCHD
2730.07	HOSC to KSC SLSL (mission/sim support)	24	NCHD
2730.08	HOSC to KSC PTCS	4	NCHD

Note 1: HOSC to RPI sites' voice services are provided by VoIP to the RPI peering point with the capability of 8 voice loops per session. RPI sites authorized for voice access via VoIP are documented in the ISS Orbital PRD Volume II.
Note 2: During BCC operations, the 24 critical voice loops from SSCC to MCC-M will be routed via HOSC.

Table 2730.1 Voice Service

2736 DATA COMMUNICATIONS REQUIREMENTS

NISN shall provide operational data communications between the SSCC, POIC, NASA Centers, and designated International Partner locations.

2736.01 SSCC AND HOSC INTERFACE

NISN shall provide a NASA Operational WAN communications service for communications between the SSCC and the HOSC. This WAN service, utilizing the Transmission Control Protocol/Internet Protocol (TCP/IP) suite of protocols, will transport the following data types: commands (payload and core), command responses, command history data files, planning data files, uplink file transfers, archived ISS Systems data, and archive requests. NISN shall provide a serial bitstream service for the transmission of simulated S-Band downlink telemetry. These data types are identified below as either operational or simulation requirements.

2736.01.01 SSCC TO HOSC DATA TRANSFER INTERFACE

a. A CIR of 112 kbps shall be provided for the transfer of operational and simulated command responses via a dedicated point to point circuit or equivalent dedicated private network.
b. A CIR of 112 kbps shall be provided for the transfer of operational and simulated command history files.
c. A CIR of 192 kbps shall be provided for the transfer of planning data files.
d. A CIR of 150 kbps shall be provided for the transfer of archived ISS Systems data files.
e. A 192 kbps, synchronous, serial bitstream data and clock service shall be provided for the transfer of simulated S-Band downlink telemetry.
f. A CIR of 4 kbps shall be provided for the transfer of real-time and simulated IAM antenna management data.
g. A CIR of 256 kbps PIP service shall be provided for the transfer of Orbiter Communications Adapter (OCA) data.
h. A CIR of 256 kbps PIP service shall be provided for connectivity from the JSC Mirror LAN to allow viewing of the ISS crew laptop screens at the POIC.
i. A NISN Mission Critical Service (for a through f) is required.
j. The interface shall provide security appropriate for “Space Operations Information” except a, g, and h which are “Space Exploration Information”.
k. The one way data transport delay (for a through f) shall not exceed 100 ms.
l. The maximum acceptable packet loss (for a through f) is .001 percent.
m. Refer to the SSCC to HOSC ICD (SSP 45001) for detailed interface requirements.

2736.01.02 HOSC TO SSCC DATA TRANSFER INTERFACE

a. A CIR of 112 kbps shall be provided for the transfer of operational and simulated commands via a dedicated point to point circuit or equivalent dedicated private network.
b. A CIR of 300 kbps shall be provided for the transfer of operational and simulated uplink files.
c. A CIR of 192 kbps shall be provided for the transfer of planning data files.
d. A CIR of 1 kbps shall be provided for the transfer of archive requests.
e. A CIR of 256 kbps PIP service shall be provided for the transfer of Orbiter Communications Adapter (OCA) data.
f. A CIR of 256 kbps PIP service shall be provided for the POIC Crew laptop connectivity to the JSC Mirror LAN.
g. A NISN Mission Critical Service (for a) is required.
h. A NISN Mission Non-Critical Service (for b through d)
i. The one way data transport delay shall not exceed 100 ms (for a through d).
j. The maximum acceptable packet loss is .001 percent (for a through d).
k. The interface shall provide security appropriate for "Space Operations Information" except e and f which are "Space Exploration Information".
l. Refer to the SSCC to HOSC ICD (SSP 45001) for detailed interface requirements.

2736.02 DSMC INTERFACE

Communications interfaces between the SSCC, the HOSC and the NIC shall be provided. Refer to the Interface Control Document between the Network Control Center Data System and the JSC MCC to SN NCCDS Operational Communications ICD for Mission Control Center Systems (JSC-11534, Vol. XVI) for detailed interface requirements.
2736.02.01 SSCC and DSMC INTERFACE FOR SCHEDULING TDRSS

Scheduling messages for ISS shall simultaneously share the same communications interfaces as the Shuttle scheduling messages. The SSCC shall supply conflict-free TDRSS scheduling messages for all ISS elements including ACS, ATV, and HTV.

a. A CIR of 64 kbps between the DSMC and the SSCC shall be provided for TDRSS Scheduling Messages. This interface shall be full duplex and shall be shared between the ISS and the SSP Programs.
b. A NISN Realtime Critical Service is required.
c. The interface shall provide security appropriate for "Space Operations Information".

d. Refer to the JSC/GSFC Operational Communications ICD for MCC Systems (JSC 11534, Vol. I, latest revision) for detailed interface requirements.

2736.02.02 CONTROLLING THE TDRSS GROUND STATION CONFIGURATION

Ground Configuration Message Requests (GCMRs) and GCMR acknowledgments for the ISS shall share the same communications interface as the Shuttle messages of the same type. The SSCC shall provide conflict-free GCMRs and TDRSS link management for all ISS elements including ISS, ATV, and HTV.

2736.02.03 PROVIDING STATUS TO THE SSCC AND HOSC (USER PERFORMANCE DATA MESSAGES)

User Performance Data (UPD) messages for all ISS elements shall simultaneously share the same communications interface as the Shuttle messages of the same type.

2736.02.04 ISS Backup Communications Team Center (BCTC)

The GSFC NIC is required to support contingency TDRSS Link management in the event of MCC closure as directed by the Flight Control Team. A team of two (2) JSC operations personnel will travel to the NIC to support ISS BCTC. GSFC will supply space and X-terminals in the NIC to support contingency TDRSS link management.

2736.03 BCC-HOSC

Refer to the BCC-HOSC Level B requirements (JSC-63742, latest revision).

2736.03.01 MCC-H CONSOLIDATED DEVELOPMENT ENVIRONMENT (CDE) AND BCC-HOSC INTERFACE

a. A CIR of 10 Mbps shall be provided for SSL-encrypted exceed on demand client server session, system and software maintenance, baseline updates, CM Server synchronization LDAP server synchronization, IPS database synchronization and FCT data file transfers..
b. A NISN NTR layer 2 service is required.
c. A NISN Mission Critical Service is required.
d. The interface shall provide security appropriate for “Space Exploration Information”.

2736.03.02 BCC-HOSC AND MCC-M/HSR INTERFACE

In the event of BCC-HOSC activation, the following service is required:

a. A CIR of 256 kbps shall be provided for two simultaneous IVoDS sessions between the HOSC/POIC and the MCC-M HSR HSG.
b. A NISN Mission Critical Service is required.
c. The interface shall provide security appropriate for “Space Operations Information”.

2736.03.03 BCC-HOSC AND WSC INTERFACE

a. The ISSOnet service is required to provide ISS S-Band Forward and Return service.
b. The IDEA interface is required to provide ISS KU-Band Forward.

2736.03.04 BCC-HOSC AND GSFC FDF INTERFACE

a. The ISSOnet service is required to provide state vectors for trajectory service.

2736.03.05 BCC-HOSC AND SDIL INTERFACE

a. The ISSOnet service is required to provide S-Band Forward and Return service to support development testing.

2736.04 SSCC AND CSA INTERFACE

The SSCC to/from CSA data transfer interface will be located at the CSA gateway at the SSCC. Exact details of the data/voice/video requirements of the interface are documented in the SSCC to CSA Ground Segment ICD (SSP 45004). CSA will provide the communications services from CSA gateway at SSCC to CSA Facilities in St-Hubert. NISN shall provide a NASA Operational WAN communications service for communications between the SSCC and CSA Facilities in St-Hubert. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: Robotics Planning Software (RPS) workstation video and NASA Administrative services.

2736.04.01 SSCC T0 CSA DATA TRANSFER INTERFACE

a. A CIR of 384 kbps shall be provided for transfer of Remote Multi-Purpose Support Room (RMPSR) RPS workstation video.
b. A NISN PIP service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. Refer to the SSCC to CSA Ground Segment ICD (SSP 45004) for detailed interface requirements.

2736.04.02 CSA T0 SSCC DATA TRANSFER INTERFACE

a. A CIR of 384 kbps shall be provided for transfer of RMPSR RPS workstation video.
b. A NISN PIP service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. Refer to the SSCC to CSA Ground Segment ICD (SSP 45004) for detailed interface requirements.

2736.05 SSCC AND MCC-M INTERFACE

NISN shall provide a NASA Operational WAN communications service for communications between the SSCC and the MCC-M gateway. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types for both realtime and simulations: Shuttle data, ECS command and telemetry, SM health and status, trajectory data, ISS commands (payload and core), ISS command responses, command history data files, realtime and recorded telemetry, planning data files, file transfers (uplink and downlink), and archived ISS Systems data. Mission data flowing between the MCC-H and MCC-M has been categorized by mission criticality as being either Mission Critical or Mission Non-critical. Negotiated agreement with NISN to modify bandwidth and availability requirements for each category is defined below; however, reliability and packet loss remain as documented in Appendix A for Mission Critical Services.

2736.05.01 SSCC TO MCC-M DATA TRANSFER INTERFACE

1. a. A Realtime Mission Critical 320 kbps data interface shall be provided to transport the following data services with a maximum restoral time of < 15 minutes:
    1. Preplanned FGB and SM commands, command responses, spacecraft downlink, command history, planning data, uplink, archive and ground-to-ground files.
    2. EIS Realtime commands.
    3. Russian Orbiting Segment (ROS) CCSDS packet telemetry.
    4. Processed Shuttle telemetry.
    5. ISS Systems telemetry.
    6. PPCP and transport messages.

   b. A NISN Realtime Critical Service is required.
   c. The interface shall provide security appropriate for "Space Operations Information".
   d. The one way data transport delay shall not exceed 700 ms.
   e. The maximum acceptable packet loss is .001 percent.
2. a. A Mission Non-Critical 640 kbps data interface shall be provided to transport the following data files with a maximum restoral time of < 3 hours:
    1. General File Transfer (planning, trajectory, flight control, security)
    2. Houston Support Room (HSR) telemetry
    3. HSR general file exchange
    4. HSR remote administration
    5. HSR remote baseline update.

   b. A NISN Mission Critical Service is required.

c. The interface shall provide security appropriate for "Space Operations Information".

3. Refer to the SSCC to RSA Ground Segment ICD (SSP 50057) for detailed interface requirements.

2736.05.02 MCC-M TO SSCC DATA TRANSFER INTERFACE

1. a. A Realtime Mission Critical 320 kbps data interface shall be provided to transport the following data services with a maximum restoral time of < 15 minutes:
    1. Shared multi-segment command data.
    2. Command Express reports.
    3. Russian Segment (RS) commands.
    4. Realtime United States On-orbit Segment (USOS) telemetry.
    5. Transfer of recorded USOS data.
    6. Transfer of uplink, downlink, planning, and ground-to-ground data files.

    b. A NISN Realtime Critical Service is required.

    c. The interface shall provide security appropriate for "Space Operations Information".

    d. The one way data transport delay shall not exceed 700 ms.

    e. The maximum acceptable packet loss is .001 percent.
2. a. A Mission Non-Critical 640 kbps data interface shall be provided to transport the following data files with a maximum restoral time of < 3 hours:
    1. Moscow Support Room (MSR) telemetry.
    2. MSR general file exchange.
    3. MSR remote administration.
    4. MSR remote baseline update.

    b. A NISN Mission Critical Service is required.

    c. The interface shall provide security appropriate for "Space Operations Information".

3. Refer to the SSCC to RSA Ground Segment ICD (SSP 50057) for detailed interface requirements.

2736.06 HOSC AND ARC TSC INTERFACE

NISN shall provide a WAN communications service for communications between the HOSC and the ARC TSC. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: Science Data (Real-Time and Dump), PIMS data, PPS data, GSE Packet definition and distribution, OCMS data, telemetry services, and commanding services.

2736.06.01 ARC TSC TO HOSC DATA TRANSFER INTERFACE

The X-Windows interface requires a CIR of 56 kbps for each active session (screen which is continually updating). The X-Windows interface requires a CIR of 56 kbps for the combined non-active sessions.

a. A CIR of 1544 kbps shall be provided for the transfer of X-window commands, command responses, PIMs data, PPS data, and uplink file transfers.
b. A NISN Premium service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. The one way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1 percent.
f. Refer to the POIC to Generic User IDD (SSP 50305) for detailed interface requirements.

2736.06.02 HOSC TO ARC TSC DATA TRANSFER INTERFACE

The X-Windows interface requires a CIR of 56 kbps for each active session (screen which is continually updating). The X-Windows interface requires a CIR of 56 kbps for the combined non-active sessions.

a. A CIR of 1544 kbps shall be provided for the transfer of X-windows session data, Payload Health and Status, realtime payload experiment data, stored payload experiment data, flight ancillary data, downlink file transfers, GSE subset, and custom data packets.
b. A NISN Premium service is required.
g. The interface shall provide security appropriate for "Space Exploration Information".
a. The one way data transport delay shall not exceed 100 ms.
b. The maximum acceptable packet loss is <1 percent.
c. Refer to the POIC to Generic User IDD (SSP 50305) for detailed interface requirements

2736.07 HOSC AND JSC TSC INTERFACE

NISN shall provide a WAN communications service for communications between the HOSC and the JSC TSC. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: Science Data (Real-Time and Dump), PIMS data, PPS data, GSE packet definition and distribution, OCMS data, telemetry services and commanding services.

2736.07.01 JSC TSC TO HOSC DATA TRANSFER INTERFACE

The X-Windows interface requires a CIR of 56 kbps for each active session (screen which is continually updating). The X-Windows interface requires a CIR of 56 kbps for the combined non-active sessions.

a. A CIR of 1.544 Mbps shall be provided for the transfer of X-window commands, command responses, PIMs data, PPS data, and uplink file transfers.
b. A NISN Premium service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. The one way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.
f. Refer to the POIC to Generic User IDD (SSP 50305) for detailed interface requirements.

2736.07.02 HOSC TO JSC TSC DATA TRANSFER INTERFACE

The X-Windows interface requires a CIR of 56 kbps for each active session (screen which is continually updating). The X-Windows interface requires a CIR of 56 kbps for the combined non-active sessions.

a. A CIR of 7.544 Mbps shall be provided for the transfer of realtime payload experiment data, stored payload experiment data, payload health and status data, flight ancillary data, ground ancillary data, downlink file transfers, GSE subsets, X-window session data, and custom data packets.
b. A NISN Premium service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. The one way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.
f. Refer to the POIC to Generic User IDD (SSP 50305) for detailed interface requirements.

2736.08 HOSC AND GRC TSC INTERFACE

NISN shall provide a WAN communications service for multicast and unicast communications between the HOSC and the GRC TSC. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: Science Data (Real-time and Dump), PIMS data, PPS data, GSE packet definition and distribution, OCMS data, telemetry services, and command services.

2736.08.01 GRC TSC TO HOSC DATA TRANSFER INTERFACE

The X-Windows interface requires a CIR of 56 kbps for each active session (screen which is continually updating). The X-Windows interface requires a CIR of 56 kbps for the combined non-active sessions.

a. A CIR of 1.544 Mbps shall be provided for the transfer of X-window commands, command responses, PIMs data, PPS data, and uplink file transfers.
b. A NISN Premium service is required.
c. The interface shall provide security appropriate for “Space Exploration Information”.
d. The one way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.
f. Refer to the POIC to Generic User IDD (SSP 50305) for detailed interface requirements.

2736.08.02 HOSC TO GRC TSC DATA TRANSFER INTERFACE

The X-Windows interface requires a CIR of 56 kbps for each active session (screen which is continually updating). The X-Windows interface requires a CIR of 56 kbps for the combined non-active sessions.

a. A CIR of 7.278 Mbps shall be provided for the transfer of realtime payload experiment data, stored payload experiment data, payload health and status data, flight ancillary data, ground ancillary data, downlink file transfers, GSE subsets, X-windows session data, and custom data packets. A CIR of 48 Mbps will be required for ULF-2 payloads.
b. A NISN Premium service is required.
c. The interface shall provide security appropriate for “Space Exploration Information”.
d. The one way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.
f. Refer to the POIC to Generic User IDD (SSP 50305) for detailed interface requirements.

2736.09 SSTF AND HOSC INTERFACE

NISN shall provide a NASA Operational WAN communications service for communications between the SSTF and the HOSC. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: simulated payload health and status data and Instructor Station (IS) Training Session Data Stream.

2736.09.01 SSTF TO HOSC DATA TRANSFER INTERFACE

a. A CIR of 256 kbps shall be provided for the transfer of simulated payload Health and Status data.
b. A CIR of 1.1 Mbps shall be provided for the transfer of IS Training Session data.
c. A CIR of 100 kbps shall be provided for the transfer of simulated S-Band telemetry data.
d. A NISN Mission Critical service is required.
e. The interface shall provide security appropriate for “Space Exploration Information”.
f. The one way data transport delay shall not exceed 100 ms.
g. The maximum acceptable packet loss is .001 percent.

h. Refer to the SSTF to MSFC POIC and RAPS ICD (SSP 50088) for detailed interface requirements.

2736.09.02 HOSC TO SSTF DATA TRANSFER INTERFACE

a. A CIR of 1.4 Mbps shall be provided for the transfer of Remote Area for Payload Support (RAPS) data and Instructor Operator Station (IOS) IS Training Session data.
b. A CIR of 100 kbps shall be provided for the transfer of S-Band command data.
c. A NISN Mission Critical service is required.
d. The interface shall provide security appropriate for "Space Exploration Information".
e. The one way data transport delay shall not exceed 100 ms.
f. The maximum acceptable packet loss is .001 percent.
g. Refer to the SSTF to MSFC POIC and RAPS ICD (SSP 50088) for detailed interface requirements.

2736.10 JSC AND KSC INTERFACE

NISN shall provide a NASA Operational WAN communications service for communications between the JSC and the KSC. This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: software loads, file transfers.

2736.10.01 JSC TO KSC DATA TRANSFER INTERFACE

a. A CIR of 192 kbps shall be provided for the transfer of flight software loads from the Software Development Integration Laboratory (SDIL) to the Space Station Processing Facility (SSPF).
b. A CIR of 224 kbps shall be provided for the Test Control and Monitor System (TCMS) from the ASI Gateway at JSC to the SSPF.
c. The interface shall provide security appropriate for "Space Operations Information".
d. A NISN Mission Critical Service is required for a.
e. A NISN Premium Service is required for b.

2736.10.02 KSC TO JSC DATA TRANSFER INTERFACE

a. A CIR of 192 kbps shall be provided for the transfer of flight software loads from the SSPF to SDIL.
b. A CIR of 512 kbps shall be provided for the Test Control and Monitor System (TCMS) from the SSPF to the ASI Gateway at JSC.
c. A CIR of 384 kbs shall be provided for compressed video from the SSPF to the ASI Gateway at JSC.
d. A NISN Mission Critical Service is required for a.
e. A NISN Premium Service is required for b and c.
The interface shall provide security appropriate for "Space Operations Information".

2736.11 HOSC TO REMOTE PRINCIPAL INVESTIGATOR (RPI) DATA TRANSFER INTERFACE

DATA: NISN shall provide a 10 Mbps Standard IP routed data service between the HOSC and each designated RPI Peering Point for the purpose of transporting telemetry data and providing an Internet interface to POIC WEB services, PPS, VoIP, and programmatic interfaces:

a. Mean Time to Restore Service (MTTR) between the NISN-provided HOSC Demarcation and a Peering Point shall not exceed 24 hours.
b. The round-trip transport delay between the NISN-provided HOSC Demarcation and a Peering Point shall not exceed 250 ms.
c. The maximum acceptable packet loss between the NISN-provided HOSC Demarcation and a Peering Point is 1%.
d. The coverage period for a Standard IP routed data service as promulgated in the NISN Services Document is acceptable.
e. NISN responsibility for performance is terminated at the Peering Point(s).
f. NISN will provide assistance in isolating outages between the Peering Point and the RPI Site, if requested.

Note: It is the responsibility of each RPI (authorized RPI sites are documented in the ISS Orbital PRD Volume II) to make the arrangements for the transfer of data from the Peering Point to their RPI location. Performance standards, restoral times, and other Service Level Agreement (SLA) type items shall be made solely between the RPI and their Internet Service Provider (ISP). There will be no NISN involvement in this process.

2736.12 SSCC AND JAXA INTERFACE

The SSCC to/from JAXA data transfer interface will be located at the NASDA gateway at the SSCC. Exact details of the data/voice/video requirements of the interface are documented in the SSCC to NASDA Ground Segment ICD (SSP 45012). JAXA will provide the communications services from the SSCC gateway to JAXA facilities.

2736.13 SSCC AND ESA INTERFACE

The SSCC to/from ESA data transfer interface will be located at the ESA gateway at the SSCC. Exact details of the data/voice/video requirements of the interface are documented in the SSCC to ESA Ground Segment ICD (SSP 45011). ESA will provide the communications services from the SSCC gateway to ESA facilities.

2736.14 HOSC AND JAXA INTERFACE

The JAXA data transfer interface will be located at the NASDA gateway in the MSFC HOSC. Details of the data/voice/video requirements of the interface are documented in the SSP-45025, HOSC and NASDA ICD. JAXA will provide the communications services between the NASDA gateway at MSFC and the JAXA facility.

2736.15 HOSC AND ESA INTERFACE

The ESA Phase II data transfer interface will be located at the ESA gateway in the MSFC HOSC. Details of the data/voice/video requirements of the interface are documented in the SSP-45026, HOSC to ESA

ICD. ESA will provide the communications services between the ESA gateway at MSFC and the ESA facility.

2736.16 HOSC AND MCC-M INTERFACE

NISN will provide a full duplex NASA operational PIP Wide Area Network (WAN) communications service for communications from the HOSC to the Russian Space Agency (RSA). This PIP WAN service using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite of protocols will provide the exchange of Mission Planning Data Files and will also be used for the Payload Information Management System (PIMS) interface.

2736.17 SSCC AND ASI INTERFACE

The SSCC to/from the Advanced Logistics Technology Engineering Center (ALTEC) data transfer interface will be located at the ASI Gateway at the SSCC. Exact details of the data/voice/video requirements of the interface are documented in the NASA/ASI Interface Definition Protocol (IDP), SSP 50612. ASI will provide the gateway in the SSCC and communications services to ASI facilities. NISN services between KSC and JSC are required for the transport of Test Control and Monitor System (TCMS) engineering data and compressed video that is bent piped to the ASI Gateway at JSC.

2736.18 MSFC HOSC AND KSC PTCS DATA TRANSFER INTERFACE

NISN shall provide a NASA Operational WAN communications service for communications between the MSFC HOSC and the KSC Payload Test and Checkout System (PTCS). This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: Payload Experiment Data, Payload Command Services, Payload Health & Status Data, and X-Windows interfaces.

2736.18.01 KSC PTCS TO MSFC HOSC

a. A nominal CIR of 5 Mbps shall be provided. This may require a future upgrade to 50 Mbps.
b. A NISN Premium Service is required.
c. The interface shall provide security appropriate for “Space Exploration Information”.
d. The one way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.

2736.19 MSFC HOSC AND KSC SLSL DATA TRANSFER INTERFACE

NISN shall provide a WAN communications service for communications between the MSFC HOSC and the KSC Space Life Sciences Lab (SLSL). This WAN service, utilizing TCP/IP protocol suite, will transport the following data types: Science Data (Real-Time & Dump), PIMS data, PPS data, GSE packet definition and distribution, OCMS data, telemetry services and commanding services.

2736.19.01 KSC SLSL TO MSFC HOSC

a. A CIR of 256 Kbps shall be provided for the transfer of commands, PIMS data, PPS data, and uplink file transfers.
b. A NISN Premium service is required.

c. The interface shall provide security appropriate for "Space Exploration Information".
d. The one-way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.

2736.19.02 MSFC HOSC TO KSC SLSL

a. A CIR of 256 kbps shall be provided for the transfer of Science Data (Real-time and Dump), PIMS data, PPS data, GSE packet definition and distribution, OCMS data, telemetry services and commanding services.
b. A NISN Premium service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. The one-way data transport delay shall not exceed 100 ms.
e. The maximum acceptable packet loss is <1%.

2736.20 JSC ISIL TO MSFC HOSC INTERFACE

NISN shall provide a NASA Operational WAN communications service for communications between the JSC ISS Systems Integration Lab (ISIL) and the MSFC HOSC. This WAN service will provide for the transport of VCDU packet formatted data from the JSC HRFM system and Ethernet UDP Packet formatted data from the JSC Payload MDM System to the MSFC HOSC.

2736.20.01 JSC TO MSFC DATA TRANSFER INTERFACE

a. A CIR of 50 Mbps shall be provided.
b. A NISN Standard IP Service is required.
c. The interface shall provide security appropriate for "Space Exploration Information".
d. The one way data transport delay shall not exceed 250 ms.
e. The maximum acceptable packet loss is 1%.

2736.21 HOSC TO HAMILTON-SUNDSTAND FACITILTY (Windsor Locks, Connecticut)

a. A 56 kbps full duplex serial clock and data interface shall be provided for the transfer of EVoDS voice.

2800 OTHER COMMUNICATIONS AND TECHNICAL SUPPORT

2805 TELEVISION

The ISS operational television is multiplexed into the Ku-Band aggregate return link and is transmitted to the SSCC as digital data. Up to four channels may be simultaneously transmitted. The SSCC will convert the digital data to standard National Television Standards Committee (NTSC) signals and corresponding analog voice. JSC will make these television and voice signals available at the JSC-located NASA Operational WAN I/F for distribution.

2805.01 TELEVISION COMMUNICATIONS REQUIREMENTS

NISN is to provide two (2) video channels to the HOSC Annex, CSA Peering Point, GRC TSC, ARC TSC and to the RPI Peering Point. NISN is to encode NTSC video sourced from JSC building 8, up to 6 Mbs per channel. JSC ISD is responsible for delivering NTSC video from JSC building 8 to the JSC NISN PIP demarcation point. Service restoration for ISD resources is <8 hours on weekdays and on-call on weekends. A NISN PIP service is required to the HOSC, ARC TSC and GRC TSC. A NISN SIP service is required to the RPI Peering Point and CSA. CSA and the RPI sites are responsible for the delivery of encoded video from the Peering Point to their facilities. NISN will provide decoding equipment at the HOSC, GRC TSC, ARC TSC and CSA to deliver NTSC outputs. At the CSA location, two (2) decoders will be supplied, with a spare to be shipped by NISN in the event of failure. The RPI sites require the video to be delivered in IP format for viewing on a PC. The ISS Orbital PRD Volume II identifies the RPI sites authorized to receive ISS video.

2805.02 ADMINISTRATIVE VIDEO TO/FROM MCC-M AND MCC-H

Use of the two administrative video streams utilizing Video Over Internet Protocol (ViIP) will be scheduled to support Soyuz and Progress dockings, and other selected scheduled events.

Note: Use of this video is desirable but not critical to operations. Availability and reliability of this bandwidth is not guaranteed for mission operations because it is administrative bandwidth.

3400 OTHER TECHNICAL SUPPORT

3400.01 SPECTRUM MANAGEMENT

OSF shall provide frequency and spectrum management services for all space-to-ground, ground-to-space, and space-to-space transmission links is specified in NASA RF Spectrum Management Manual (NPG 2570), and NASA Policy Directive (NPD) 2570.5B.

APPENDIX A. GLOSSARY

Ancillary Data:

Ancillary data is a selected subset of core systems data and other onboard generated data (including payload generated data) required by users to supplement data for payload data analysis. This data is necessary for executing real-time operations and for analysis of payloads by ground controllers as required. It contains state vectors, spacecraft attitude data, etc... Ancillary data describes the flight environment in which the payload is operated.

Command

Standard Command - maximum of sixty-four 16-bit words consisting of three word Consultative Committee for Space Data Systems (CCSDS) primary header, five word CCSDS secondary header, two word Legal Station Mode indicators, up to fifty-three actual command words, fill words - used only with ground-generated commands [the Assembly Contingency Baseband Signal Processor (ACBSP) requires twenty-four word minimum commands], and one Add without Carry Checksum word.

Data Load Command - maximum of two hundred eighty-eight 16-bit words consisting of three word CCSDS primary header, five word CCSDS secondary header, five words of address and valid station mode information, up to two hundred seventy-four actual data words, and one Add without Carry Checksum word.

Payload Commands - reference above command definitions as applicable to payloads.

Command History Data:

The command history shows the execution status of the commands issued from the ground or by the crew and the commands automatically executed on board. It includes the following items:

a) Command name and type
b) Issuer and addresses
c) Issuance time and execution time
d) Reception approval and rejection
e) Execution results
f) Other

Committed Information Rate (CIR)

The amount of network bandwidth guaranteed to be available for a particular WAN service. When a particular source of data bursts above the CIR for that service, service availability is only guaranteed for the CIR.

Critical

An availability category. Any ground support function required to assure safety of the crew and survival of the ISS. Data which, if unavailable, could cause irreparable damage, including possible loss of the crew, the station, or the associated capability to process vital data. Services classified as critical require immediate restoration in the event of a failure.

Increment

During ISS assembly phase, the time period between the launch of a particular crew until the undocking from the ISS of the return vehicle for that crew.

Integrated Planning System (IPS)

IPS is a collection of computer-based tools used for flight planning. These include trajectory analysis, mission planning, robotics analysis and planning, shuttle ascent and descent, resource analysis, and direct mission support for near real time planning and analysis. The IPS ground communications requirements will be derived as file transfer requirements.

Non-critical Highly Desirable

An availability category. Restoral of failed services classified as Highly Desirable may be accomplished within 2 hours without creating a hazardous condition to the ISS or USGS.

Non-critical Routine

An availability category. Restoral of services classified as Routine may be accomplished within 24 hours without creating a hazardous condition to the ISS or USGS.

Operations Data:

Essential and extended telemetry data describing the status of onboard systems necessary for successful mission operations and the crew's health and safety. This data is contained in the Command and Control (C&C) Multiplexer/Demultiplexer (MDM) Current Value Table (CVT) and downlinked in the S-Band telemetry. Also referred to as "core systems" data.

Payload Flight Ancillary Data:

Ancillary data is a selected subset of core systems data and other onboard generated data (including payload generated data) required by users to supplement data for payload data analysis. This data is necessary for executing real-time operations and for analysis of payloads by ground controllers as required. It contains state vectors, spacecraft attitude data, etc.. Ancillary data describes the flight environment in which the payload is operated.

Payload Health & Status:

Payload H&S data consists of sensor data of payloads and equipment in the experiment racks and status data of payloads and racks output by the control equipment. This data does not include science data. Payload H&S data is a subset of payload data required by the ground/Payload Operations Integration Center (POIC) to monitor payload conditions onboard the station. It will be rack level and payload level data and can include elements of ancillary and safety data. This data is downlinked via S-Band.

The following description of POIC H&S downlink is extracted in whole from the Payload Systems Development Handbook, D683-70830-1 Revision A:

The content of the POIC H&S downlink is specified in part by the Payload Executive Processor (PEP) Status Definition Table. The PEP Status Definition Table contains up to 1 Kbytes of CVT data. The remaining portion of the POIC H&S data consist of payload H&S data. The data that is downlinked via Ku-band from this service typically includes but is not limited to the following data items:

a) Payload Executive Software (PES) History Log - information collected on the processing of PES.
b) PES Service Status Data - information on the current state of services being provided to payloads.
c) PES Mode - current PES system mode.
d) Core Systems Data - various elements of core systems data required by the ground.
e) Payload Health & Status data - includes elements of ancillary data and safety data.

f) Automated Payload Switch (APS) Status data
g) Payload Ethernet Hub/Gateway (PEHG) Status data

Payload Systems Data:

Health and Status information from the experiment equipment is a subset of Payload Systems data. Payload Systems data includes normal hardware and software configurations and status telemetry. Payload systems data includes that data pertaining to payload support systems (PEHG configuration, APS status, etc...) that will allow the ground to monitor the systems. This data is downlinked via Ku-band.

Performance Categories:

The NISN Services Document describes four service performance categories for IP routed data services. Those descriptions and the accompanying table are provided solely for informational purposes below.

1. Real-time Critical Service - This service provides a mission critical level of data networking connectivity with emphasis on meeting real-time telemetry transport through the use of the IP suite. Real-time Critical IP service is primarily differentiated from Mission Critical IP service in that it is engineered with a high level of redundancy to achieve the added level of availability. This service employs the same security and connectivity features and limitations as the Mission-Critical service. Agency policy dictates the use of IP as the Agency standard protocol for data networking. Other protocols are supported on a legacy basis only

2. Mission Critical Service - This service provides a mission critical level of data networking connectivity through the use of the IP suite with very controlled access and security measures. Mission Critical IP service is differentiated from standard IP service in that it is engineered as a very closed system to support spaceflight mission critical telemetry and data flows. All systems and facilities connected to the Mission Critical IP service must meet the specified Information Technology security level. Access to and from the general Internet and other NASA IP services is extremely limited and on a strict exception basis only. Mission Critical IP service is most appropriate for critical spaceflight mission support data and telemetry flows that require an extremely high level of availability for mission success and that require no general Internet access. Agency policy dictates the use of IP as the Agency standard protocol for data networking. Other protocols are supported on a legacy basis only

3. Premium Service - Premium IP service is differentiated from standard IP service in that it provides a higher performance level, higher priority for problem resolution, and is not directly connected to the general Internet. Premium IP connectivity to the general Internet is through a controlled gateway and is implemented on an exception basis only. Premium IP service is most appropriate for internal Agency networking requirements where the Agency's operations should be isolated from the general Internet. Agency policy dictates the use of IP as the Agency standard protocol for data networking. Other protocols are supported on a legacy basis only.

4. Standard Service - Standard IP service is the commodity Internet service that provides the Agency’s link to the Internet in general. It provides basic universal Internet connectivity with minimal performance guarantees or restrictions on acceptable use. Standard IP service is open to the public to access publicly available NASA information sources such as World Wide Web services. Agency policy dictates the use of IP as the Agency standard protocol for data networking. Other protocols are supported on a legacy basis only.

Performance Specifications for IP Routed Data

IP Service and Performance Parameters

Service	Availability	Restoral Time	Coverage Period	Acceptable Packet Loss	Round Trip Time
Real-time Critical	99.98%	< 1 minute	24X7	.001%	<120 ms
Mission Critical	99.95%	2 hours	24X7	.001%	<120 ms
Premium	99.50%	4 hours	24X7	<1%	<100 ms
Standard	99.50%	<24 hours	6 AM Eastern to 6 PM Pacific M-F	1%	<250 ms

Realtime (RT) Payload Data:

Actual experiment data from the payloads. Data collected by the instrument. Also referred to as Science data. Downlinked via Ku-band.

Systems Health & Status (H&S) data:

System H&S data consists of sensor data of core systems and status data of control equipment. A subset of operations data.

Voice Over Internet Protocol

Voice over Internet Protocol (VoIP) is a means of providing extension of Mission voice conference nets to desktop workstations via common IP based networks. Audio is transmitted as User Datagram Protocol (UDP) and is accessed through a WEB browser interface. Packets can also be encrypted and encapsulated for enhanced security.

APPENDIX B. ACRONYMS

ACBSP -	Assembly Contingency Baseband Signal Processor
ACS -	Assembly Contingency Subsystem
AIS -	Automated Information System
APS -	Automated Payload Switch
ARC -	Ames Research Center
ARTEMIS-	Advanced Relay and Technology Mission Satellite
ASI -	Agenzia Spaziole Italiana (Italian Space Agency)
ALTEC-	Advanced Logistics Technology Engineering Center
ASRS -	Automated Support Requirements System
ATV -	Automated Transfer Vehicle
ATVCC -	ATV Control Center
BCC -	Backup Control Center
BCC-HOSC -	Backup Control Center – Huntsville Operations Support Center
BCTC -	Backup Communications Team Center
C & C -	Command and Control
CCSDS -	Consultative Committee for Space Data Systems
CDE -	Consolidated Development Environment
CIR -	Committed Information Rate
CNES-	Centre National d'Études Spatiales
COR -	Communications Outage Recorder
COTS-	Commercial Orbital Transportation Services
CSA -	Canadian Space Agency
C & T -	Communications and Tracking
CVT -	Current Value Table
DFRC -	Dryden Flight Research Center
DSMC-	Data Service Management Center
DoD -	Department of Defense
ELV -	Expendable Launch Vehicle
ESA -	European Space Agency
ESTEC -	European Space Research and Technology Centre
ESTL -	Electronics Systems Test Laboratory
EVA -	extravehicular activity
EVoDS -	Enhanced Voice Distribution System
FDF -	Flight Dynamics Facility
FEL -	First Element Launch
FEPR -	Front End Processor Replacement
FIPS -	Federal Information Processing Standards
GCMR -	Ground Configuration Message Request
GN -	Ground Network
GRC -	John Glenn Research Center at Lewis Field
GRGT -	Guam Remote Ground Terminal
GSE -	Ground Support Equipment
GSFC -	Goddard Space Flight Center
HOSC -	Huntsville Operations Support Center
HRFM -	High Rate Frame Multiplexer
HSR -	Houston Support Room
HTV -	H-II Transfer Vehicle
HTVCC -	HTV control Center
H & S -	Health and Status
ICD -	Interface Control Document
IDEA -	ISS Downlink Enhancement Architecture
IOS -	Instructor Operator Station

IP - International Partner
IP - Internet Protocol
IPS - Integrated Planning System
ISIL - ISS Systems Integration Lab
ISS - International Space Station
ISSOnet- ISS Operational Network
ISSPO- ISS Program Office
IVoDS- Internet Voice Distribution System
JAXA - Japan Aerospace Exploration Agency
JSC - Johnson Space Center
kbps - kilobits per second
kHz - kilo Hertz
KSA - Ku-band Single Access
KSAF - Ku-band Single Access Forward
KSAR - Ku-band Single Access Return
KSC - Kennedy Space Center
LOR - Line Outage Recorder
MA- Multiple Access
Mbps - megabits per second
MCC-H - Mission Control Center - Houston
MCC-M - Mission Control Center - Moscow
MDM - Multiplexer/Demultiplexer
EIT - Element Integration Test
MCS - Mobile Computing System
MHz - Mega Hertz
MMT - Mission Management Team
MSFC - Marshall Space Flight Center
MSN - Mission
MSR - Moscow Support Room
MTTR- Mean Time to Restore
NACAIT - Network and Communications Analysis and Integration Team
NASA - National Aeronautics and Space Administration
NASDA - National Space Development Agency of Japan
NCCDS - Network Control Center Data System
NCHD - Non-Critical Highly Desirable
NCR - Non-critical routine
NIC- Network Integration Center
NISN - NASA Integrated Services Network
NIST - National Institute of Standards and Technology
NLT - No later than
NMI - NASA Management Instruction
NPD- NASA Policy Directive
NPG - NASA Procedures and Guidelines
NPR - NASA Procedures and Requirements
NPRD - Network Program Requirements Document
NSTS - National Space Transportation System
NTSC - National Television Standards Committee
OCA - Orbiter Communications Adapter
OCMS - Operations Control Mission Software
OSF - Office of Space Flight
P/B - Playback
PDSS - Payload Data Services System
PEHG - Payload Ethernet Hub/Gateway
PEP - Payload Executive Processor
PES - Payload Executive Software

PID - Program Introduction Document
PIMS- Payload Information Management System
PN - pseudorandom noise
POIC - Payload Operations Integration Center
PPS - Payload Planning System
PTC - Payload Training Capability
PTCS - Payload Test and Checkout System
RAPS - Remote Area for Payload Support
RMPSR Remote Multi-Purpose Support Room
ROS- Russian Orbiting Segment
RPI - Remote Principal Investigator
RPS - Robotics Planning Software
RS - Russian Segment
RSA - Russian Space Agency
RT - realtime
SCIO- Space Communications Integration Office
SDIL- Software Development Integration Laboratory
SER - Scientific, Engineering and Research
SGS - Space to Ground Subsystem
SIM - Simulation
SLSL - Space Life Sciences Laboratory
SM - Service Module
SN - Space Network
SRS - Support Requirements System
SSA - S-Band Single Access
SSAF - S-Band Single Access Forward
SSAR - S-Band Single Access Return
SSCC - Space Station Control Center
SSPF- Space Station Processing Facility
SSTF - Space Station Training Facility
STDN - Space Tracking and Data Network
STS - Space Transportation System
TBD - To Be Determined
TBS - To Be Supplied
TCMS- Test Control and Monitor System
TCP - Transmission Control Protocol
TDRS - Tracking and Data Relay Satellite
TDRSS - Tracking and Data Relay Satellite System
TN - TDRSS Network
TOCC- TDRSS Operations Control Center
TSC - Telescience Support Center
UAB - University of Alabama at Birmingham
UDP - User Datagram Protocol
UDS - Universal Documentation System
UF - Utilization Flight
UPD - User Performance Data
USGS - United States Ground Segment
USOS - United States On-orbit Segment
VCDU - Virtual Channel Data Unit
VHF - Very High Frequency
VoIP - Voice over Internet Protocol
VV - Visiting Vehicle
WAN - Wide Area Network
WFF - Wallops Flight Facility
WSC - White Sands Complex

ZOE - Zone of Exclusion